

# **NATURAL GAS PRICE VOLATILITY**

## **I. Summary**

This brief white paper on natural gas prices is intended to discuss the potential for natural gas prices to be very volatile during the winter of 2003-04. Prices are already high and natural gas commodity futures prices (see New York Mercantile Exchange's website; [www.nymex.com](http://www.nymex.com)) suggest even higher prices for next winter. Some analysts have even analogized the situation to *The Perfect Storm*—where a confluence of conditions could add up to a very serious situation for the nation's natural gas consumers. The table is set for such a confluence to take place. Among the conditions already existing are:

- Low levels of natural gas storage.
- Weakened financial health of energy industry.
- High natural gas prices during the storage season.
- Reduced numbers of energy trading firms, causing reduced market liquidity.
- High prices of crude oil.
- Natural gas well depletion in traditional production areas of the United States and Canada.
- Increased use of natural gas to fuel electric generation in the United States.
- Fewer drilling rigs (compared to 2001).
- Little or no exploration/exploitation of new drilling regions.

Ironically, it is weather that needs to be added to the already existing situation to bring a storm of perfect proportions to consumer's bills. The Board believes that few are truly prepared for a significant natural gas price rise and the most vulnerable among us are not prepared at all—and may not be able to prepare in and of themselves. While the Board does not predict natural gas prices, we can foresee that high to very high natural gas prices are a distinct possibility for next winter.

## **II. Introduction**

The price of natural gas is affected by numerous factors such as weather, economic activity, and availability of supplies. Depending upon the strength and timing of these factors, the price of natural gas can increase or decrease dramatically. The recent trends of many of these factors has lead us, as well as other analysts, to the conclusion that natural gas prices will likely be higher this coming heating season (possibly much higher), with the potential for large price fluctuations. Concern over this possibility and the impact it could have on

consumers and the Iowa economy, and the need to alert Iowa's leadership of the potential problem is the purpose of the following analysis and report.

An analysis of natural gas price volatility is, perhaps, best understood with an overview of natural gas production and transmission. Natural gas is, for the most part, a domestically produced commodity. The Gulf region, Southwestern states, the Rocky Mountain area, and portions of the Appalachian Mountain area are the main production areas within the United States. A larger and larger portion is being imported from Canada, but most of the natural gas consumed in the United States is still produced within its borders. Once natural gas is released from production wells, it goes into a pipeline system that delivers it to customers throughout the country. Because production and transport of natural gas are fairly constant, the fluctuations in demand are dealt with by injections into and removals from storage. The storage 'fields' are usually constructed from old natural gas production formations, salt caverns, or large aquifers located near distribution areas. Long-term supplies can be increased by finding new sources of supply and adding more production capacity and, if necessary, pipelines. However, in the short-term, fluctuations in demand are usually met by injections into, or withdrawals from storage.

Because natural gas storage is so critical in balancing the demand for natural gas, it is considered by many to be the most important supply-side factor in determining the price of natural gas in the near term. As such, it serves as a hedge against price volatility in addition to its role in assuring operational integrity/deliverability of natural gas to customers. Storage levels must be adequate to cover the increased demand in the heating season, including peak day use. These necessary levels are achieved by injections into the storage fields during the non-heating season (April-October).

### **III. Market Forces That Impact Natural Gas Prices**

#### **DEMAND FACTORS**

Like any other freely traded good or service, there are numerous market forces that determine the demand for natural gas. Time and space do not allow for a rigorous discussion of each factor. Instead, the focus will be on the main factors that could shape the demand for natural gas in the coming months.

#### Weather and Increased Use of Natural Gas to Fuel Electric Generation in the United States

As might be expected, one of the main demand factors impacting market prices will be weather. During the heating season cold weather causes demand for natural gas to increase and warm weather has the opposite effect. If one is concerned about prices going up sharply, the obvious weather pattern to look for is colder than normal weather. If we have a colder than normal winter, especially

if the winter is much colder in the first month or two of the heating season (e.g. the winter of 2000-2001), demand for gas will increase, perceptions of potential shortages may arise, and the price of natural gas will increase. Not so obvious is the impact that summer weather has on the demand for natural gas, and storage. Many of the electric generating units used in the United States for intermediate and peaking purposes (air conditioning on warm days) use natural gas for fuel. Because of this, warmer than normal weather in the summer (earlier in some parts of the South and West) means that more natural gas will be used for electrical generation purposes, and less will be available for additions to storage.

#### Economic Activity

The economy, or overall economic activity is also a major factor that determines the demand for natural gas. If there is more economic activity, particularly industrial activity that uses natural gas as a fuel, there is increased demand for natural gas. Of course everyone wants to see a thriving economy that provides opportunities for everyone, but it must be recognized that increased economic activity in the face of limited supplies of natural gas will cause upward pressure on prices.

#### Prices of Alternative Fuels

Another import factor to watch when estimating future natural gas prices is the price of alternate or competing fuels. In many industrial processes, the manufacturer can either burn natural gas or some type of heating oil. For electric generation if the price of fuel oil is high enough, generation that burns natural gas becomes more economical and will displace some of the units that burn fuel oil. Earlier this year the price of crude oil (the source of petroleum products) was well over \$30 per barrel; a price level that could cause some fuel switching. The price of crude oil has since declined, but if economic or political issues surface that cause the price of crude oil and the products that are derived from it to increase, it could cause the demand for natural gas to increase.

## **SUPPLY FACTORS**

#### Low Levels of Natural Gas Storage

Due to the unseasonably cold weather this past heating season in many parts of the Eastern United States, we find ourselves at historically low natural gas storage levels. Total U.S. Storage is currently at 821 billion cubic feet (bcf), which is 824bcf, or 50%, lower than last year. Storage needs to recover to approximately 3,000 billion cubic feet by November. To do so, nearly 90 billion cubic feet need to be added to storage each week. Such levels of storage injection over such a long period of time would be unprecedented. Low levels of storage can cause perceptions of shortage and lead to higher prices

#### Weakened Financial Health of Energy Industry

Complicating the need to have storage levels recover is the weak financial health of the energy industry overall. Many firms that used to store gas no longer

participate in the market. Others that do participate have limited creditworthiness and a weakened capability to attract the capital necessary to purchase gas.

#### High Natural Gas Prices During the Storage Season

High prices of gas during the storage season make firms think twice about making purchases for injection to storage. Some firms serving customers in states with gas supply competition face the potential of having their gas supply be uneconomically priced next winter. Others in states where regulatory agencies may tend to do Monday morning quarterbacking look at the prudence of gas purchase decisions, face significant regulatory risk and balk at purchases at such high price levels.

#### Reduced Numbers of Energy Trading Firms

In the aftermath of the Enron scandal and scandals involving energy trading in California markets, many firms have ceased trading activities. Aquila Inc., which serves Iowa customers through its regulated retail arm—Aquila Networks, is such a firm. Even though Aquila was not demonstrated to have participated in improper behavior, it was forced to exit the market. Trading firms provided a very tangible service to the market—providing much needed liquidity. Their departures have reduced market liquidity. Reduced liquidity can help foster price spikes.

#### Natural Gas Well Depletion and Lack of New Drilling Areas

Natural Gas wells are depleting more quickly in traditional production areas of the United States and Canada. As they deplete, less gas flows.

Given the nearly constant production levels throughout the year, the main factors that impact the supply of natural gas tend to be the ones that impact storage levels. For example, one of the main producing areas of natural gas is the Gulf Coast region. Hurricanes can interrupt the flow of natural gas from this area. The more hurricanes they have in that region, and the more severe they are, smaller amounts of natural gas can be produced and sent to storage facilities.

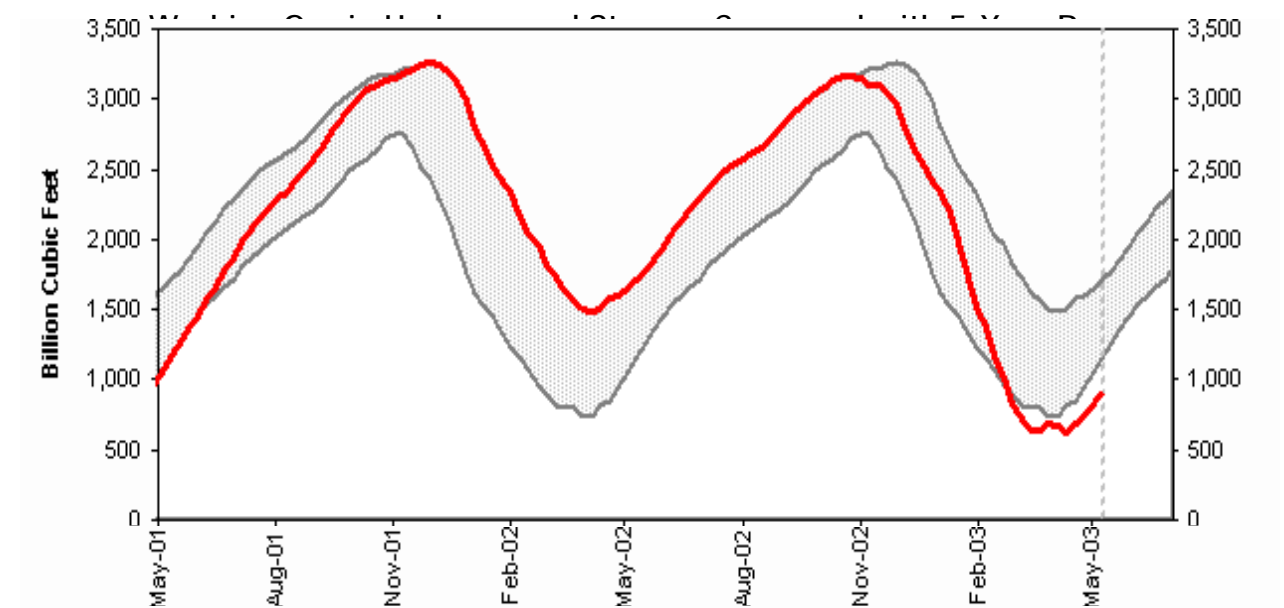
As mentioned earlier, factors such as summer weather and economic activity can add to the demand for natural gas during the time period when most of the injections into storage take place. All of these factors take away from the supply of natural gas that could be used to increase storage supplies. The result is even tighter supplies in the winter with more volatile natural gas prices.

### STATUS OF CURRENT FACTORS

At the moment, the factors that determine demand levels for natural gas are sending mixed signals. As mentioned earlier, crude oil prices have declined over the past few months, but they could increase at any time depending upon numerous political and economic factors. Also, they need to decrease even more to provide their full dampening effect to natural gas prices. The much-anticipated economic recovery still has not materialized, and there is a lot of

uncertainty over when it will happen and how strong it will be. The weather on the other hand, although difficult to predict, is already having an impact on storage levels. Warmer than normal temperatures in the southern states this spring have caused more natural gas to be used for generation of electricity and less to go into storage.

The main supply factor, storage, is starting from a difficult position. Storage levels were drawn down to record lows this past heating season (see figure below). Starting from such low inventory levels makes it difficult to reach normal operating levels. Any sustained interruptions in storage injections will make it very difficult, if not impossible, to reach the storage levels necessary to meet the demands of the system and keep prices from becoming very volatile. Continued warm weather this spring and summer or interruptions in supply due to hurricanes in the Gulf region could make it nearly impossible to achieve necessary storage levels.



Notes: A weekly record for March 8, 2002, was linearly interpolated between the derived weekly estimates that end March 1 and the initial estimate from the EIA-912 on March 15. The shaded area indicates the range between the historical minimum and maximum values for the weekly series from 1998 through 2002.

Source: Weekly storage values from March 15, 2002, to the present are from Form EIA-912, "Weekly Underground Natural Gas Storage Report." Values for earlier weeks are from the Historical Weekly Storage Estimates Database, with the exception of March 8, 2002.

The actual impact upon supplies and price won't be known for several months, but the markets are already beginning to anticipate the impending 'storm'. Prices for natural gas deliveries over the next several months are already twice as high as they were a year ago. Many analysts believe the best scenario we can

anticipate for the coming winter, is that natural gas prices will remain at their current levels, and not go much higher. However, most analysts also recognize that the price could go much higher than it is today. If this scenario does unfold, the best that consumers could anticipate (assuming a normal winter) is natural gas bills that are twice as high as normal. If we get colder than normal weather and prices for natural gas increase even more, consumers could see even larger bills with a devastating impact.

## IV. The Role of Gas Hedging

Local distribution gas utilities purchase natural gas on behalf of their customers, generally on a short-term basis, at prevailing market prices. In recent years, these short-term market prices have been significantly more volatile during the heating season, compounded by cold weather volatility and its effect on gas usage. Natural gas hedging activities involve the use of financial instruments to stabilize the utility's gas purchase costs, and include both price and volume hedging. Price hedging reduces the risk from price fluctuations, and volume hedging reduces risk related to weather. These activities augment the utility's traditional use of gas storage contracts for reducing price and weather risk.

Financial instruments used to hedge price risk include NYMEX contracts, call options, and option collars. NYMEX contracts are futures contracts for natural gas purchased on the New York Mercantile Exchange (NYMEX). These contracts lock-in prices for specific volumes of natural gas, scheduled for later delivery during the heating season. Utilities can either take physical delivery of the volumes on the specified date or settle the contracts financially.

**Call options** are financial instruments that grant utilities the right (without obligation) to purchase specific volumes of natural gas at specific ceiling prices during the heating season. Thus, if market price is higher than the call option ceiling price at the time of gas purchase, the utility can exercise the option and purchase at the lower ceiling price. By using call options, utilities can establish maximum price limits for the upcoming heating season, at a fraction of the cost otherwise paid for NYMEX contracts.

**Option collars**, involve the sale of **put options**, which can be used to offset the up-front cost of call options. The sale of put options obligates the utility to purchase specific volumes at a specific floor price during the heating season. By combining put and call options in an option collar, the utility minimizes its total up-front options cost, and establishes a fixed, guaranteed price range for gas purchases during the heating season, as defined by the put floor price and call ceiling price.

Financial instruments are also used to hedge volume risk. These involve call options and option collars based on weather reference points (measured in heating degree days – or HDD) rather than price. A weather call option results in cash payment to the utility if weather is colder than the HDD ceiling. This cash payment is then used to offset the utility's increased gas purchase volumes. As with price hedging, option collars can be used to offset the up-front cost of call options, establishing a fixed HDD weather range for gas purchases during the heating season. If weather is warmer than the HDD floor, the utility must make a cash payment; but this will be offset by the utility's reduced gas purchase volumes.

It is important to note the market has short term volatility such as day-to-day and month-to-month. However, it also has long-term volatility such as year-to-year and period-to-period. For example, this five years compared to that five years.

**Hedging deals well with short-term volatility, but hedging instruments of the sort we've described do not deal as well with long-term volatility. Only long-term contracts have a chance of dealing with long-term volatility.**

Since dollar cost averaging doesn't work with long-term supply arrangements, it is easy to "guess wrong" about the imponderables of long-term market forces (and utilities have some fear of Monday-morning quarterbacking of purchasing decisions, when "wrong guesses" are made). Market forces can change drastically as an organization buys for the long haul (even spread out in small increments over a year is really nothing for 5-10 year purchases) in one time period. Also, since no supplier is a willing long-term seller in a down market (if a purchaser for the long-term wants to lock in the low prices of the down market) buying long term contracts gives LDCs reduced capability to participate in the benefits of lower short-term market prices. The Board has occasionally received inquiries from parties suggesting that utilities ought to just lock in their prices when gas prices are low. The Board is confident they would if they could.

## **V. Actions Taken By Iowa's Investor-Owned Natural Gas Local Distribution Companies (LDC)**

In 1994, the Board issued an order allowing Iowa's investor-owned natural gas LDCs (regulated gas public utilities) to use financial instruments to help ensure against price volatility of natural gas as a commodity. The order allowed the LDCs to pass the costs and benefits of the hedging activities through their purchased gas adjustment clauses. Full implementation of the Natural Gas Wellhead Price Decontrol Act of 1988, as of January 1, 1993 had left prices of natural gas free from regulation at both the state and national levels. The Board's order allowed utilities more tools to help protect their regulated customers against fluctuating prices.

For several years, relatively little financial hedging activity took place. Then the winter of 2000-01 happened. Month-ahead natural gas prices tripled from periods less than a year prior. Customer bills skyrocketed. In the aftermath of that winter, the Board directed its staff to meet with utilities to emphasize to them the need to utilize available tools to help contain customer bill volatility. Meetings with each of the utilities took place and financial hedging activity has increased markedly since. Board personnel continue to meet with the LDCs at least in the spring each year. The utilities have responded well. Each LDC has a hedging plan that includes at least storage and use of financial hedges against price volatility. In 2001-02 one utility asked the Board and OCA's opinions about volumetric hedging—using financial tools to hedge against the increased usage and higher bills that accompany colder than normal heating seasons. Both the Board's General Counsel and OCA provided an opinion that the Board's 1994 order was sufficiently broad to allow volumetric hedging. All LDCs have since been informed of the availability of volumetric hedging. Two of the four LDCs have since added volumetric hedging activities to price hedging and storage as ways of controlling volatility of customer bills.

Though there is always an ability to improve performance, much of what can be gained from the use of financial hedging has probably already been gained by Iowa's LDCs. Those improvements will help, but they may not be enough for next winter.